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U.S.-JAPAN SCIENCE AND TECHNOLOGY EXCHANGES: AN INTERVIEW WITH MARTHA CALDWELL HARRIS OF THE NATIONAL RESEARCH COUNCIL

Summary

A considerable exchange of science and technology has taken place between the United States and Japan over the past 20 years. For the better part of this period the United States was preeminent in so many different scientific fields that bilateral cooperation often was based on technology transfers from the American side. In recent years, however, it has become increasingly apparent that Japanese laboratories are engaged in important scientific and technological research from which the United States also can benefit. But because of differences in the two countries' research and development systems as well as the language barrier, it has not been easy for American scientists to become involved in Japanese research projects in a meaningful way.

Martha Caldwell Harris, director of the National Research Council Office of Japan Affairs, recently discussed with JEI Senior Political Analyst Barbara Wanner her office's role in evaluating problems and policy issues relating to science, technology and U.S.-Japan relations. She also commented on opportunities and difficulties that confront American scientists interested in participating in Japanese research projects.

Q. The National Research Council Office of Japan Affairs is relatively new. Would you briefly explain how and why it was established and what some of your goals are?

A. The National Academy of Sciences and the National Academy of Engineering conducted a series of discussions over a two- to three-year period with leaders from Japanese industry and academia to discuss broad issues in U.S.-Japan relations. There were two meetings -- one in Santa Barbara and one in Kyoto -- where U.S. and Japanese participants discussed issues concerning high technology and the environment.

As a result of those discussions, which were very wide-ranging and quite productive, the academies decided it would be a good idea to have an in-house resource, a staff of people assigned to think about U.S.-Japan issues, particularly in science and technology. Thus, more than a year and a half ago, the decision was made to set up such an office. Last spring I joined the staff of the National Research Council, which is the operating arm for the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine. The Office of Japan Affairs, which currently has three staff members, is precisely this in-house resource. I should add that in developing our program, we were very fortunate to have an advisory committee, chaired by former Defense Secretary Harold Brown, which contributes valuable expertise in science and technology.

Our purposes are threefold. First, to serve the academy complex, that is, to help other offices that are working on almost any field of science and technology where they need to know something about what is going on in Japan. In some instances we might help these offices by informing them of sources of information or people they should contact in government agencies, universities or the private sector. Sometimes we help with translation or by doing briefings or giving advice. As you can imagine, the academy receives many Japanese visitors, including industry leaders and Japanese government officials. We offer help with arrangements to ensure that they are meeting with the appropriate academy offices.

Our second purpose is to promote useful, beneficial, two-way exchanges between the American and the Japanese science and engineering communities. Of course, over the past 20 years there have been considerable science and technology exchanges between the United States and Japan. We try to focus on matters of concern to senior scientists and government officials in each country. During our first year we organized meetings that brought together specialists from each country to discuss issues such as "symmetrical access" to the research and development being conducted in the United States and Japan.

Q. What are some of these areas of debate? Research in superconductivity or other leading-edge sectors, for example?

A. It may well be that as time goes by specific fields of research, such as optoelectronics, will be the focus of a discussion. In our meetings to date, however, we have emphasized certain "issue areas." For example, there has been a lot of debate concerning lack of foreign access to Japanese science and technology and the imbalance in technology flows between the United States and Japan. The questions we hope to explore through bilateral discussions concern what can be done about this, the nature of the real problems, and so forth.

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Another example is a project designed to analyze the R&D systems in the two countries, a comparison and contrast of the way research is done in the United States and Japan. The basic rationale for this project is that in order to improve U.S. access to Japanese science and technology, it is important for American scientists and engineers as well as policymakers and the general public to understand how Japan's R&D system works. This should make it easier for American scientists and engineers to participate in the Japanese system effectively. Understanding the organizational context of S&T research is essential for improved access.

The third purpose of the Office of Japan Affairs is to look ahead at emerging policy issues that are generated by the changing relationship between the United States and Japan in the area of science and technology. What kind of U.S.-Japan S&T relationship will be possible and desirable in the next century? This question is related, of course, to the broader issues of trade policy, defense cooperation and development assistance.

Q. Concerning the second project you mentioned, do you see any significant differences in the way R&D is conducted here versus the way it is conducted in Japan? Do the two systems appear incompatible?

A. I would not say the two systems are completely incompatible, but certainly there are some significant differences that affect the ability of foreigners to participate in Japan. In both countries, interestingly enough, the research systems are changing in an effort to respond to new challenges. But because of differences in the ways R&D is funded and the traditional, vertical organization of research -- in Japanese universities, for example -- the problems and the answers may be different. Understanding those differences is important for a foreign researcher who is thinking about going to Japan and vice versa.

Let me give you an example of the kind of project in which we are involved. Thanks to U.S.-Japan Foundation funding, we will hold three meetings involving senior U.S. and Japanese scientists, engineers and research managers. At each session we will focus on a different aspect of the organizational environment for research. The first meeting we held looked at university-based research and development in the two countries. We found that there were some very interesting contrasts as well as some similarities between U.S. and Japanese university-based R&D.

One of the contrasts, for example, concerns the strength of the chair system in Japan, in which there is a senior professor under whom junior professors and younger researchers work. This is a very strong tradition in Japan and, thus, it has important implications for bilateral science and technology exchanges. The traditional image is that the chair system is stable and vertical in nature -- that is, it permits less leeway in terms of research topic selection and perhaps less recognition for younger researchers than does the U.S. university-based system.

In this country there is greater mobility of people. Researchers do not necessarily expect that they will stay within a particular setting for a long time. There also may be a good deal of entrepreneurialism in looking for research funding.

If we are going to improve U.S. access to the R&D going on in Japanese labs, American researchers have to take into account the different research context in Japan. Research tends to be very group-oriented in Japan. If the foreigner is aware of this characteristic and has no problems with it, then he or she probably can fit in and pursue research that complements the group effort. If, however, a foreigner wants to pursue a new but related direction in research, but the university research group is not working in that area, it might be difficult to get it off the ground.

There are other important differences in the two R&D systems. Most people believe that the United States is quite strong in basic research, particularly in university-based programs. And, as a general comparison, Japanese university research is not of the same quality across the board. Another difference concerns R&D funding. In Japan industry funding is much stronger, while in the United States government funding plays a much greater role. This means that Japanese corporations are the driving force behind Japan's R&D effort and that technology developed by Japanese corporations is of great interest to the rest of the world. And it is not just "technology" in a narrow sense -- it is the total organizational system for innovation, production and marketing that puts the know-how to use.

The point is that none of these differences is insurmountable, but they have to be understood and taken into account. And the context is changing in both countries. In Japan, for example, experimentation with new approaches to university research is under way, with the goal of encouraging younger researchers and collaboration across disciplines and with foreign partners.

Q. Regarding the group-oriented nature of Japanese research projects, do you think members of the American scientific community who charge that it is inordinately difficult to do research in Japan are people who want to do something new, rather than, as you say, participate in a complementary capacity in an existing project?

A. For a long time we in the United States have focused on developing our own research and did not pay much attention to monitoring and examining what was going on abroad. In recent years, however, the global context has changed. Americans are beginning to wake up and say, "Look at the trade numbers, look at the technology development going on in Japanese labs." There is a broader recognition that in order to change some of these statistics over the long run, it is important to increase our understanding of organizational factors in the Japanese setting.

But quite frankly, as some American researchers who have gone to Japan have noted, it is true that foreigners have difficulty becoming fully integrated into the Japanese research context. There is a dilemma of whether foreign researchers are treated as guests or as fellow participants. Sometimes being treated as a guest works a little bit to one's disadvantage -- if one is isolated from the major work of the lab, for example.

The problems of foreign researchers in Japan are not, in general, because the Americans wish to depart from the ongoing research project, or because we do not do collaborative research in the United States -- in fact, we do. We should think beyond just the numbers, look at the quality of the collaboration and the participation and devise new approaches to ensure that cooperation is meaningful and good for both sides.

Q. I am under the impression that for a long time the U.S. scientific community adopted an inward-looking approach to basic research. In other words, "no one does it better than we do." Would you agree with that impression? Also, has it been relatively easy or difficult for your office to generate interest in the U.S. scientific community for Japan-based research?

A. Let me clarify one important point. The NRC's Office of Japan Affairs really is not designed to facilitate scientific exchanges in the traditional sense. Rather, it is the National Science Foundation, a government agency, that has responsibility for implementing fellowship and other scientific exchange programs. The role of the NRC's Office of Japan Affairs is a little bit different. We see ourselves as complementing the NSF's efforts, but one major purpose is to evaluate problems and policy issues relating to science, technology and U.S.-Japan relations. Our office makes available to individuals within the NAS as well as outsiders information concerning various research opportunities to steer these people in the proper direction. But we do not provide fellowships for individuals to go to Japan or administer any traditional exchange programs.

Concerning your question about the attitude of the U.S. scientific community, I see it a slightly different way. You used the term "inward-looking," but in many ways our scientific community and university-based research organizations have been quite open to foreign engineers and scientists over the years. It was not that past U.S. research efforts were insular so much as we were overwhelmingly preeminent in so many different scientific fields. Thus, when we did cooperate with another country it more often was a cooperation based on teaching and technology transfer from the U.S. side. Further down the road, however, as Japan's scientific capabilities continue to grow, I think we will see more opportunities for two-way technology flows -- and more equitable cooperation.

Q. A bilateral science and technology agreement was concluded last year ostensibly to facilitate reciprocal science and technology flows. From your vantage point, have you observed any immediate payoffs from this agreement, or do you think we will reap the benefits further down the road?

A. Since the agreement was signed only last summer, I think it is fair to say that we are still in the beginning stage of implementation. Although our office was not formally involved in the negotiations, we are watching implementation closely. Conclusion of this agreement was an important step in furthering bilateral science and technology exchanges. It is my impression that it took some time to reach an accord, but the fact that both sides have agreed on some general principles concerning comparable access and mutually beneficial technology exchanges is an important accomplishment.

Over the longer term, however, a great deal of work will have to be done in order the realize the goals of the agreement, particularly if both sides expect to see expanded cooperation in certain scientific fields. We are living in an environment of intense market competition where national security interests are also of paramount concern. For these reasons, crafting cooperative research projects will take time.

One of the interesting things about the agreement is that it sets up a fairly complicated administrative and management structure. There is a cabinet-

level government group, which presumably will deliberate policy questions, as well as a working-level government group, which will work to implement the accord. In addition, there is a group of private-sector advisers. Inclusion of the latter group, in particular, is an important new development.

I think it is very important to get private-sector input. There is a great deal of research activity in the private sector, in companies and in universities in both countries, that is being conducted quite separate and apart from government-sponsored programs. In reality, the cooperative projects undertaken under the rubric of the bilateral agreement will be only a small part of a much larger picture of U.S.-Japan cooperation and competition in science and technology.

Q. There seems to be a growing concern on Capitol Hill and in certain administration offices that U.S. economic interests are not being carefully assessed in concluding military joint development deals. In other words, the Pentagon is allowing U.S. allies -- that are also commercial competitors -- access to defense technology that can be spun off into civilian applications which, in turn, will enable our allies/competitors to beat out certain U.S. sectors. This is an argument one hears with regard to Japan's development of its next-generation fighter support aircraft, FSX. How will this growing sentiment affect attainment of some of your office's goals?

A. We live in a world where contributions of technologies developed in the civilian sector will be increasingly important for military systems and vice versa. We cannot artificially separate the two sides. I think that, realistically, economic concerns must be taken into account in structuring arrangements that the United States and Japan view as mutually beneficial.

Although there is a climate of concern, I believe it will be possible to find opportunities for collaboration. In the area of basic science, for example, research projects can be designed that do not readily fall into a civilian or defense category. I think that is the direction in which the bilateral agreement is oriented.

Q. I imagine the language barrier can be a pretty significant obstacle to getting more American scientists to Japan. Do you see more time and resources being devoted to training American scientists in "technical" Japanese?

A. Unquestionably, language is an important factor in bilateral science and technology exchanges. Unless a foreigner can speak Japanese, his or her research experience in Japan will always be defined by interactions with people who are fluent in English or with English-language publications. And, needless to say, that is only one small part of what is going on in Japanese science and technology. This is a longer-term issue for the American scientific community.

But I do see some important changes. For example, the Massachusetts Institute of Technology has a special technical language program. The program has been well received and appears headed on the right track. Overall, I observe a growing interest in Japanese language study. That is a very positive sign, but the key point is how long people will stick with it. In order to be really fluent, you have to spend many years studying Japanese and, ideally, some time in Japan.

I also would add the following, however. We probably would be too pessimistic if we concluded that an experience in a Japanese lab would not be very useful unless one is fluent in Japanese. Certainly, the more Japanese one understands, the more one can participate in the research group effort -- and attend the kenkyukai and understand the informal communication between and among members of the group.

But even without that fluency, an experience in a Japanese lab can be meaningful. We should not discount the benefit that could come from learning more about how research is done in Japan, learning more about the Japanese community of scientists and engineers, as well as taking advantage of an opportunity to do good research in certain fields.

Q. Do you think it is valid to say that Japan's only interest in technology transfers is so it can acquire the means to beat U.S. industry?

A. Like most general impressions, there may be some truth to that view, but there probably is some misunderstanding. First of all, one should have a better understanding of the effort that is required to assimilate technology. The general assumption is that one can easily pick up technology off the shelf and take it home and assimilate it -- like one picks up a loaf of bread. What Japan's experience has shown us is that a lot of value is added in the assimilation process -- value that contributes to a sometimes higher quality product. I also would emphasize that tremendous resources and efforts have gone into Japan's learning from abroad.

However, it will be very difficult to determine how much technology is going in either direction, primarily because we do not have unambiguous indicators. For example, we have a trade balance to which we can refer and conclude that we are "in the red" or "in the black." But to measure science and technology exchanges one would have to look in so many areas, such as direct investment, numbers of foreign researchers, numbers of patents filed and so forth. There are many, many things one would have to consider to get a comprehensive view.

Beyond that we also need an understanding on a more micro level. Today we are seeing more private-sector joint ventures and cooperative relationships. Sometimes benefits from these activities, in terms of technology exchanges or capital inflows, are not readily apparent to an outside observer.

For all of these reasons, it is very understandable that confusion has arisen over which directions the science and technology exchange arrows are pointing. There are probably lessons that can be learned from some of the joint ventures, particularly those ventures in which we see some hybrid organization of management and production techniques bringing together the best of U.S and Japanese approaches.

As industry goes global, technology assimilation will be increasingly important, for the United States as well as Japan. What we can say for certain is that there are many signs of Japan's growing strength in various scientific and technological fields. This will increase opportunities for bilateral collaboration from which the United States could learn from Japan, but these interactions will have to be structured carefully to ensure that both sides benefit.

Timing is critical. If the general public and the policymaking leadership see evidence that collaboration between the United States and Japan in science and technology clearly benefits both sides, the likelihood of frictions and restrictions will diminish. The question is whether this will happen, and happen soon enough to allay uncertainties on both sides.

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APPENDIX

Table 1: U.S. Research and Development Work, 1981-89

(in millions of dollars)

A: By Funding Source

Calendar Year	Universities	Industry	Federal Government	Total*
1981	$1,555	$35,946	$33,404	$71,866
1982	1,735	40,101	36,512	79,364
1983	1,936	43,524	40,691	87,280
1984	2,107	49,107	45,377	97,793
1985	2,377	52,358	51,668	107,757
1986	2,789	53,950	54,331	112,497
1987	3,145	56,722	57,291	118,782
1988 (estimated)	3,470	60,430	60,500	126,115
1989 (projected)	3,800	64,035	62,700	132,350

B: By Performance Sector

Calendar Year	Universities	Industry	Federal Government	Total*
1981	$6,845	$51,810	$8,425	$71,866
1982	7,324	57,995	9,141	79,364
1983	7,883	63,403	10,582	87,280
1984	8,623	71,470	11,572	97,793
1985	9,694	78,269	12,945	107,757
1986	10,926	80,631	13,535	112,497
1987	12,082	85,500	13,413	118,782
1988 (estimated)	13,000	90,600	14,500	126,115
1989 (projected)	13,900	95,350	14,750	132,350

*Total by funding source includes federally funded R&D centers, while that by performance sector includes federally funded R&D centers and nonprofit organizations.

Source: National Science Foundation

Table 2: Japan's Research and Development Work, FY 1981-FY 1987

(in millions of dollars*)

A: By Funding Source

Fiscal Year	Domestic		Foreign	Total
	Government	Private		
1981	$7,087	$19,180	$27	$26,294
1982	6,674	19,450	28	26,152
1983	7,284	23,066	35	30,385
1984	7,280	25,016	31	32,327
1985	8,446	31,729	37	40,211
1986	12,233	45,231	49	57,513
1987 (preliminary)	n.a.	n.a.	n.a.	71,099

B: By Performance Sector

Fiscal Year	Research Institutes	Universities	Industry	Total
1981	$3,986	$6,354	$15,954	$26,294
1982	3,803	6,170	16,179	26,152
1983	4,109	6,980	19,295	30,385
1984	4,231	7,061	21,035	32,327
1985	5,249	8,095	26,866	40,211
1986	7,759	11,465	38,290	57,513
1987 (preliminary)	10,025	14,149	46,926	71,099

*The underlying total figures are: FY 1981, Y5,982.4 billion; FY 1982, Y6,528.7 billion; FY 1983, Y7,180.8 billion; FY 1984, Y7,893.9 billion; FY 1985, Y8,890.3 billion; FY 1986, Y9,192.9 billion; and FY 1987, Y9,836.6 billion. These figures were converted at the following average annual exchange rates: FY 1981, Y227.52; FY 1982, Y249.64; FY 1983, Y236.33; FY 1984, Y244.19; FY 1985, Y221.09; FY 1986, Y159.84; and FY 1987, Y138.35.

Source: Management and Coordination Agency

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